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**STAIRWAY TO HEAVEN? RETHINKING ANGEL INVESTMENT POLICY
AND PRACTICE**

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Abstract

Angel investing has grown globally across economies, accompanied by growth in both academic and policymaking interest. In this paper, we critically analyse the current state of knowledge about the process and impact of angel investment. We use a series of stylised facts to highlight key trends as well as misperceptions about those trends. These include the rise of formal and ad hoc angel groups, the efficiency of early stage risk capital markets, the complex interaction between angel and institutional venture capital, and policymaking to address perceived capital market failures. We review the emerging literature on angel investment returns and draw on a new simulation-based analysis of tax incentives to challenge the rationale for government intervention in angel investing.

Key words: angel investment; returns; simulation; tax incentives; market failure; public policy

Highlights

- The "facts" of angel investing are not consistently supported by research
- Simulation of angel investing portfolios reveals high risks and variability
- The impact of tax credits on angel investment returns is disproportionate
- Rigorous research needed on market inefficiencies in early stage venture funding
- More research needed on angel/VC interaction, deadweight and success incentives

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1 Introduction

Notwithstanding the absence of comprehensive, robust and reliable data (Cumming and Johan 2017), research on angel investing has developed significantly since the early 1980s (Drover et al 2017; Edelman et al 2017; Wallmeroth et al 2018; White and Dumay 2017). Furthermore, the angel market itself continues to evolve; becoming more institutionalised as angel groups gain prominence (Mason et al 2019). Beyond altruism and the desire to support the entrepreneurial economy, the rationale for angel investment is that the investor will secure above market risk adjusted returns on their investment in the form of capital gains over the medium to longer term (Harrison et al 2016).

There has been considerable policy interest in developing initiatives to stimulate and grow the angel investment market (Mason 2009; Carpentier and Suret 2016). Government intervention has been justified on the basis that it addresses market inefficiencies and coordination failures that restrict access to finance by new high-growth potential ventures (Murray, 2007). In so doing, it helps realise the economic contribution of these ventures through tax incentives which rebalances the investor's risk-reward profile to encourage more investment.

The fundamental rationale for angel investing, from both investor and government perspectives, is predicated on the generation of positive returns, yet despite recent contributions this remains a significantly under-researched area (Gregson et al 2017). Further, the market failure argument remains weak. To the extent that market failures exist, in principle, there is a role for public policy (Boadway and Tremblay 2005), given that the early stage risk capital market is characterized by high levels of uncertainty, information asymmetry and agency costs with the potential for superior market returns. Understanding more clearly the distortionary

effects of market failure which justifies public funding to support private investment activity is an important issue for policy, practice and theory. Given this, in this paper we have two objectives. First, we summarise the current state of knowledge about angel investing, in the form of a series of stylised facts. Second, drawing on a simulation model of the role of tax incentives in angel investing, we reassess the arguments for and justification of government intervention in this market.

2 Background: Stylised Facts of Angel investment

The overwhelming view in both research and policy is that angel investment is a good thing: it contributes to new venture creation and growth, it benefits entrepreneurs, investors and society at large and more of it is better than less. This view rests on a number of ‘stylised facts’ - a simplified presentation of an empirical finding or a broad generalization that summarizes data, which although essentially true, may have inaccuracies in the detail (Arroyo Abad and Khalifa 2015) - about angel investment which were either never fully true or have become less so over time. Recognition of this qualifies the panglossian optimism of most angel research and calls into question the basis for the current levels of government support for this market. We identify six stylised facts that dominate angel research and shape the design and delivery of policies to develop the market (Table 1). In each case, the conventional wisdom is being challenged or contradicted by more recent research findings or by the evolution of the angel investment market itself.

Table 1 about here

The first stylised fact is that angel capital is available capital to which entrepreneurs have access more or less irrespective of their location (OECD 2011). In fact, although more widely available than institutional VC (Angel Research Institute 2018), given the predominance of entrepreneurial experience in the angel investor population, angel capital is not universally available but is governed by and reflects the spatiality of the existing entrepreneurial economy.

The second stylised fact is that angel capital is local capital. However, a significant minority of angels make longer-distance investments, particularly where the investment is larger, they have specialised investment preferences or where they can co-invest with trusted associates (Harrison et al 2010). Increased international angel investment is likely as it is a growing theme in the angel investment and policy communities (Harrison 2017; Coleman and Robb 2018).

The third stylised fact is that angel capital is bridging capital in a multi-stage entrepreneurial process, each of which is associated with a different financier, from the ‘4Fs’ (family, friends, fools and fans), through angel investors to VCs and private equity to IPO. However, this sequential view has recently been challenged on the basis of a series of structural changes in the early stage risk capital market (Mason et al 2019), and angel investors are becoming ‘cradle to grave’ investors, seeing their portfolio companies through multiple rounds to eventual exit (Harrison et al 2010; Mason et al 2015). The fourth stylised fact is that angel investment is productive investment: however, while angel investors expect lower returns over a longer time horizon than VCs (Shane 2012), ‘is it worth it?’ studies (Mason and Harrison 2002) highlight the high loss rates in angel investing, the rarity of exceptional returns and the need for very large portfolios to generate consistent positive returns (Gregson et al 2017).

3 Market failure and the equity gap

The fifth stylised fact is that the angel market is an inefficient market characterised by information and signalling deficiencies that make it problematic for would-be investors and investees to meet (Collewaert et al 2010), information asymmetries between investors and investees that lead to adverse selection and moral hazard problems (Landstrom 1995), and different risk-returns expectations held by actors in the market (Ivashina and Lerner 2019).

However, there is no simple definition of market failure (Martin and Scott 2000). What market failure is not is an observed gap between the presumed demand for investment and the (lesser)

supply of capital. Investors may not meet the demand for capital for economically rational reasons, in that the risk-adjusted returns in form of the cost of capital required of investees (e.g. the percent of firm equity surrendered or the interest rate on debt) do not clear the market and match supply and demand. On this basis, the role of government on economic and/or welfare grounds is to adjust risk-reward profile to a market-clearing rate by incentivising or compensating investors to increase the availability of capital (Cumming et al 2018). However, this entrepreneurial finance market differs from conventional markets in that ‘the classical supply-and-demand apparatus does not apply to ... the capital market, particularly the market for capital going to entrepreneurs’ innovative projects’ (Phelps 2009, 50). Rather, this market is a matching process which matches financiers with compatible entrepreneurs.

This matching process is not, however, seamless. The need for finance may not be translated into demand for finance, depressing the supply of finance and discouraging demand as ventures realign their aspirations in the light of their perception of the funding market. This represents a *demand failure* as ventures with a need for finance fail to turn that into effective demand. Alternatively, the need for finance may generate a justified demand for finance, and *market failure* is represented in the gap between the justified demand for finance and the non-provision of that finance. There is, however, a further aspect of demand in this market which is rarely discussed: *artificial demand* exists in the form of a demand for finance in the absence of need and occurs when a proposal does not meet the criteria of investors (for example, in terms of growth potential or scalability). To the extent to which artificial demand is reflected in inappropriate finance provision, there is a market failure in terms of the over-supply of finance.

A significant proportion of government intervention in the entrepreneurial finance market, justified on the basis that it is needed to address a supply-side market failure, is in fact associated with the creation of market failure by leveraging inappropriate finance provision to support artificial demand. Government - as an actor in the entrepreneurial finance market,

whether as direct investor (public sector venture capital funds), co-investor or through tax incentives - is as much the source of market failure as the solution. As Lerner (2009) has expressed it, with respect to a comparison with the US venture market, although government support has almost always been required to get entrepreneurial finance markets off the ground, 'the low returns in the European venture markets are as much a consequence as a cause of the massive public interventions in these markets'. This leads inevitably to our final stylised fact.

4 Taxation and Angel Returns

The sixth stylised fact is that government support is necessary to develop and maintain the angel investment market through support for the establishment and operation of business angel groups and networks, tax incentives and coinvestment schemes (Mason 2009; Harrison 2018; Owen and Mason 2017). There has, however, been little assessment of the effectiveness of these activities. This is particularly the case with respect to tax incentives, which represent the largest financial commitment by government to the development of the angel market.

Although few impact studies of the effects of taxation on angel investment levels in general and investment returns in particular are available (Ali et al 2017), there is a growing body of research that suggests that tax incentives stimulate angel investment (Cicchello et al 2019; Barkoczy and Wilkinson 2019; Cumming and Li 2013), encourage more angel investment in early-stage high-risk ventures (Lipper and Sommer 2002; Maula et al 2005; Aernoudt et al 2007; Hughes 2010; Hendon et al 2012), help correct market imperfections and distortions arising from moral hazard and information asymmetries (Keuschnigg and Nielsen 2004; Gordon 2018), support the success of fund-raising campaigns (Ralcheva and Roosenboom 2016; Signori and Vismara 2016; 2018), and significantly increase the returns to angel investors (Gregson et al 2017; Carpentier and Suret 2016).

On this basis, angel tax credits to subsidize early-stage investors by providing personal income tax credits equal to a certain percentage of their investment irrespective of the investment outcome have been widely adopted (including Canada, UK, France, Germany, Ireland, Portugal, Spain, Sweden, China, Japan, Brazil, Australia and 31 states in the US – Denes et al 2019; Tuomi and Boxer 2015), and the wider adoption of tax credits is being actively promoted as a mechanism for expanding the angel market globally (OECD 2011).

However, while the primary goal of providing tax incentives is to improve after-tax returns for investors as an inducement to take on the risks and uncertainties of investing in this market (Boyns et al 2003), ‘little is known about whether this objective has been reached. Further, data related to the exit of the investors involved in this type of program are extremely scarce’ (Carpentier and Suret 2016, 348), and little is known about the effects of tax incentives on investors and start-ups (Denes et al 2019). Tax incentives may be counterproductive and socially wasteful if the financial returns from non-viable ventures are unsatisfactory (DeGennaro, 2012). While the availability of tax credits may lead to an increase in the volume of angel investment, this may be in the form of channeling additional investment from new investors with worse access to deals and less experience in screening start-ups into lower quality start-ups launched by less experienced entrepreneurs (Denes et al 2019). Given the evidence of assortative matching in the angel investment market, such that more experienced investors match with higher quality firms (Hsu 2004; Sørensen 2007; Ewens et al 2019), this leads to the question of whether or not policy-makers should subsidize angel investing to support regional economic and job growth, if this is not generating appropriate risk-adjusted returns (Shane 2009; Gregson et al, 2013; 2017; Mason and Brown 2013; Pierrakis 2011).

Given this paucity of information, we have explored for the first time, the impact of tax on angel investment returns by simulating, using Monte Carlo methods, angel investing portfolios using the same dataset as in previous studies (Gregson et al 2017; Dutta and Folta 2016; Zhou

and Kato 2017) (The simulation methodology is summarized in Appendix 1). In this analysis we simulate the effect of both a tax credit (corresponding to the income tax relief applicable at the time of the investment) and of capital gains tax regimes (governing the returns to the investor at exit). Figures 1 and 2 compare Median IRR (showing portfolios up to 50 investments and all portfolio sizes respectively) for the base (main) simulation, the simulation with capital gains tax, the simulation with the tax credit, and the simulation with both the capital gains tax and the tax credit. Results show that as the portfolio size increases, the tax credit benefit disproportionately outweighs the capital gains tax cost.

Figures 1 and 2 here

The simple modeling of taxes resulted in a 25% reduction of IRR, while the 25% tax credit generates an effective increase in IRR of nearly 50%. As portfolio size increases, the tax credit benefit disproportionately outweighs the capital gains tax cost, and tax credit benefits are actually improved for larger portfolios; effectively reducing the negative impact of capital gains tax. This suggests advantages for more professional angels with larger portfolios and for angel groups. These results confirm the importance of tax incentives for stimulating the flow of angel investment and are consistent with prior research (Cicchello et al 2019; Barkoczy and Wilkinson 2019; HMRC 2016). With the exception of a number of passing comments about the impact of income tax relief on angel investment providing ‘an immediate guaranteed return on their investments’ (Cicchello et al 2019; see also Boyns et al 2003; Mason and Harrison 2002), the research reported here is the first to demonstrate systematically the impact of taxation on the returns to angel investment.

However, given new evidence that angel investor tax credits are ineffective in promoting high-quality entrepreneurship (Denes et al 2019), we can conclude that the provision of such incentives adjusts the risk-return profile in such a way as to divorce angel returns from the

underlying economic potential of their investee companies on the one hand, and encourages the entry into the market of inexperienced investors on the other. These findings are consistent with those of Carpentier and Suret (2016), who in their review of different tax credit regimes for angels, identify very limited evidence that tax incentives for angels are effective at the firm level. Earlier research by these authors found that the combination of strong tax incentives and lack of selection capacity in tax credit programs ends up directing funds to companies with very low profitability, most of which disappear after a few years (Carpentier and Suret, 2007).

Co-investing policies that attempt to encourage larger investments can also tie up disproportionate amounts of capital. As discussed above, our analysis shows that the investment size–return relationship proposed in prior studies is not clearly supported by the AIPP data-set, calling into question policies based purely on increasing deal size and suggesting that beyond a certain point, increasing angel investment size may actually generate lower returns. There may also be high deadweight from tax incentives if investments already taking place are supported (Hellmann et al 2017; Dutta and Folta 2016). These deadweight costs appear to increase with company size, which suggests that tax incentive schemes should target smaller firms (HMRC, 2016). As tax incentives can reduce the effective marginal cost of investing, in theory, more investors should be willing to supply more capital to smaller companies and at lower before-tax expected rates of return. However, from a macroeconomic perspective, tax incentives can be distortionary, leading to sub-optimal allocation of investment (e.g. to start-up companies with a lower rate of return) (European Commission, 2017).

The scale of government support for the early stage risk capital market can be significant (Table 2)²: the cost of tax relief on qualifying investments in the UK exceeds £1bn annually, relative

² Although venture capital trust (VCT) investment, made through managed pooled investment vehicles, does not meet the accepted definition of angel investment (investment decisions are taken by the fund manager, not the individual investor, and investments can be made in quoted as well as unquoted companies) it is included here as an important part of the government's package of support for early stage companies.

to gross investment through these schemes of £2.86bn (2017-18 data: EIS £1.93bn; SEIS £189m; VCT £745m). By way of comparison, total venture capital investment in the UK in 2018 was £0.99b, of which £169m was seed and startup capital (BVCA 2019).

Despite the opportunity costs involved, however, there is little evidence on the relative importance and economic efficiency of this cost of tax relief. In addition to the expense and complexity in administering tax incentive schemes, the usefulness of tax incentives also depends on the state of the economy and on the possibility of finding suitable investments (Mason, 2009). For many regions, the issue is not one of the supply of investment capital but the lack of demand from growth-aspiring businesses (Parliament 2012-13). Nor is there any evaluation of front-end tax relief (designed to increase the flow of funds committed to the market) versus back-end incentives (designed to reward success by incentivising exits), which some commentators believe to be more effective and less costly in exchequer terms (Barkoczy and Sandler 2007), notwithstanding the difficulties in taxing (and giving relief on) gains as they accrue and the portfolio distorting effects of a realisations basis tax (Gammie 2000). Indeed, the provision for the clawback of tax reliefs within a certain qualifying period (as is the case with the UK's EIS scheme, for example) can lead to a situation where activities that might otherwise be in the company's interest are not carried out: in effect, the tax relief becomes more important than the business objective (Law Society 2008).

Table 2 about here

Angel investment is frequently represented as 'smart' money, reflecting the post-investment value-added contribution of entrepreneurially experienced investors to their portfolio companies (Politis 2008; 2016). However, there has been no assessment of the distributional and welfare effects of incentivising the flow of short-term 'dumb' money (passive investment from non-entrepreneurially experienced high net worth individuals that floods the market and

skews valuations – Ibrahim 2014, 13; Boué 2007) into the market in terms of, for example, its impact on inflating valuations (and hence diminishing prospective returns) (European Commission 2012). Nor has there been any assessment of the mobilising of investment from informal investors (the so-called ‘family, friends and fools’) rather than from value-added angel investors who can impact new venture success (Carpentier and Suret 2016; Tuomi and Harrison 2016). Given the evidence on constant returns to scale in the angel finance market, and the corresponding absence of multiple equilibria that would justify government intervention, Cipolloni and Giordani (2019, 14) urge caution ‘in justifying direct policy intervention on the demand or on the supply side of angel finance.’

5 Conclusions

The scale of government support for angel investment throws into sharp relief the question of ‘is it worth it?’ In theory, government intervention is justified if market failures exist and policy prescriptions address clear market distortions with measurable effect. Given the distribution of returns to investors discussed above, where investment write-offs are more common than home runs, and the evidence that the tax incentives themselves are a primary driver of returns to investors, the answer to this question is ‘possibly not’.

The paper challenges some accepted ‘stylised facts’ informing current policy prescriptions for the angel market. We specifically note where our simulation model updates our understanding of these facts, as well as where future modelling research could add further value. In conclusion, we highlight three key issues for research and policy: the displacement effect on venture capital; the role of deadweight; and the modelling of back-end incentives.

5.1 Displacement effect on venture capital

Much of the entrepreneurial finance literature has been predicated on the existence of a risk capital ‘funding escalator,’ whereby venture capitalists rely on a deal flow of promising start-

up ventures, which have been funded through their early stages by local angels. From a theoretical perspective, angel and VC funding are viewed as a complementary, synergistic investment process (Harrison and Mason 2000). However, there is little evidence of a ‘stepping stone’ role for angel investment, with angel and VC funding appearing to be dynamic substitutes. The availability of angel capital is governed by and reinforces the spatiality of the existing entrepreneurial economy, with credentializing pushing the highest quality entrepreneurs in a locality to VC rather than angel funding. While our simulation dataset did not include information on VC participation, many of the investments were active more than 10 years, well beyond the time horizon of most VC funds. This presents an extremely interesting opportunity for future research. A dataset that includes VC and angel investing activity, including firms with both angel and VC investors, would enable portfolio-based simulation that compares returns. It could also explicitly consider whether angel investing benefits from displacing or feeding into professional venture capital. No such data set exists (Dutta and Folta 2016). However, one study which combined data from the AIPP dataset with Thompson One VentureXpert data demonstrated that 58 of 136 angel group backed ventures also received seed/early stage VC investment (39 of which did so in the same year that they received angel investment), and that VC involvement was associated with greater innovation quality and a faster realization of returns (Dutta and Folta 2016).

This reference to the importance of angel groups challenges another accepted stylised fact, that of the ‘traditional’ model of the solo angel investor committing their own investment capital to a small number of investments. Given the overall distribution of returns and the disproportionate influence of the rare black swan investments, our simulation suggests the need for angel investors to build a significant portfolio of investments to be reasonably sure of making an overall acceptable return. While the ‘professionalization’ of angel investing through

angel groups has allowed for more syndication of investments and portfolio ‘risk-spreading,’ very few angel groups can manage sufficiently large investment portfolios.

5.2 *The role of deadweight investments*

On the basis of our simulation results and of our summary of the ‘stylised facts’ about the angel market, we suggest that the predominance of supply-side policy prescriptions, through co-investment schemes, tax incentives or direct investment (government VC funds) have leveraged inappropriate finance provision to support artificial demand, resulting in low risk capital returns. While public funding may result in more bad deals getting funded by less experienced or less active angels, there is still no objective way to identify *a priori* the outlier winners in the early stage risk capital market. This is the problem of deadweight investments, which tie up capital and other ecosystem resources. Future research could extend our modelling work by identifying or building independent investment quality measures into a returns simulation. Deadweight is currently hard-coded into the model via the random selection of investments into each portfolio. The available dataset’s only “measure of quality” is the exit value. Modelling deadweight requires decoupling quality from outcome; this could be accomplished in future research with datasets that have an independent measure of quality (e.g. team prior experience, board qualifications, patents) or via a pure simulation in which a novel quality variable was incorporated that was statistically linked to outcomes.

At the same time, however, if one accepts that there is plenty of investment capital but a shortage of investable deals (Mason et al 2019), government intervention through the tax system - in the form of front-end incentives in particular - represents an encouragement to individuals to participate in this market in a manner and on a scale that is predicated to result in a loss of their investment capital. This transfers the systemic risk of the cost of incentivising these investments to the general taxpayer citizen in a regressive redistributive manner. The

simulation clearly demonstrates that tax credits disproportionately increase the perceived return to angel investing, because the value of near-term tax credits is magnified due to the long hold time of many angel investments. Given that angel research and policy-making have to date prioritised a focus on the supply side of the market we believe that it is also worth considering shifting the focus to the demand side. This would address two emerging problems in the market. First, incentivisation of ‘dumb money’ (Macht and Robinson 2008) into the market, through provision of tax incentives and other measures, could be restricted in the interests of both the investors involved, the businesses in which they might invest and the government itself, who has to carry the consequences of business failure and underperformance that ensue. Second, improving the effective justified demand for angel investment from high-growth potential investable business ventures would be enabled by focusing attention on investment readiness programmes (Mason and Kwok 2010; Mason and Harrison, 2004).

5.3 *Back-end incentives and investment returns*

In light of the evidence on the returns to angels and other issues raised in this paper, we suggest that widespread incentives to encourage the front-end commitment of additional capital to the market could be reconsidered. Future research should explicitly model back-end incentives, such as tax deferrals on exit within a given time-frame, to explore ways to provide explicit incentives for successful business growth, exit and reinvestment. However, modelling back-end incentives and their link to outcomes presents an intriguing challenge for exploring policy options for angel investing. It requires two new elements: the policy incentive and the model mechanism. We explore the model mechanism first. One option would be to create a randomized “early exit” variable. As each investment is selected into a portfolio during a run, that variable would determine whether investments with exits take advantage of an earlier, smaller exit opportunity. For example, an investment that takes 8 years to generate 15x return could, based on a separate random number calculation, have an option to exit at 6 years and

10x. In another run, however, the random number calculation might generate no alternatives. Creating the stochastic model for the number of years as well as the return adjustment will require careful consideration; to our knowledge no research exists providing guidance on early exit opportunity prevalence or implementation.

The related question is the nature of the policy incentive. The “early exit” variable is a black box— it assumes that there is some type of exogenous incentive without making it explicit. The obvious policy mechanism, tax relief on early exit, appears to provide tax relief for exiting early on the assumption that investors could have waited longer for a larger exit, which is something angel investors have little control over in practice (Harrison et al 2016). It is difficult to imagine what information investors would provide to government to justify this. It is also not obvious how the tax relief should be structured: as we have noted above, tax relief on capital gains could include the rollover or carrying forward of capital gains and losses or the provision of loss relief on a more favorable basis than the baseline tax system. Also, the use of minimum holding periods could be structured to support the generation and capture of knowledge spillovers and increase stability to capital structure in a way that reflects angel holding period patterns and norms. The use of maximum holding periods, on the other hand, may encourage investors to prematurely exit investments to retain tax relief and/or only select those investments that mature quickly or are close to the point of divestment. Notwithstanding the danger of a minimum holding period to retain the tax incentives leading to prioritization of tax benefits over business objectives, there is growing consensus that it is more desirable for tax incentive schemes to utilize a minimum holding period, rather than a maximum holding period or having no holding period requirement (European Commission, 2017). Providing the evidence base for such choices is a major future research agenda item.

An alternative would be something like a tax-increment-finance (TIF) policy as in the US, where taxes are deferred to a time when the organization is more able to pay them. Here, the

understanding might be that the angel would reinvest some or all of the exit capital (including what would have been paid in taxes) into new deals, and would not have to pay taxes until some or all of those investments are realized. From a modelling point of view, linking the policy to the early exit model mechanism presents a major technical and data challenge. In the case of direct tax relief, the model would presumably generate the potential randomized early exit, generate the anticipated value of the tax relief, and compare this against a hypothetical investor's IRR preferences. The TIF version requires a further series of calculations to estimate how taxes would be repaid, which would involve running the model recursively, since the expected value to the investor, and the taxes to be paid, are the result of future investing activity.

5.4 *Summary*

In summary, we have argued that the rationale for and scale of government intervention in and support for the angel investment market is predicated on a number of stylised facts – the universality and availability of angel capital, the localism of angel investment, the bridging role of angel capital in the ‘funding escalator’, the productive nature of angel investment, the inefficiency of the market, and the need for government support. The results of recent research into the angel market (in particular the rise of angel groups, the collapse of the funding escalator, and the long-tail distribution of returns on investment) challenge some of these stylised facts. Specifically, we have highlighted the problematic role of angel tax incentives in generating investor returns, attracting inexperienced investors and channelling investment to more marginal businesses. On the basis of this we conclude that the role and scale of government involvement in the angel investment market needs to be seriously rethought.

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Appendix 1 Simulation Methodology

Sampled from the largest available angel returns data set, the Angel Investor Performance Project (AIPP) dataset is described in one recent review as the most reliable angel returns dataset (McDonald and DeGennaro 2016). This has been used in prior analyses (Wiltbank and Boeker 2007; McDonald and DeGennaro 2016; Gregson et al 2017; Zhou and Kato 2017). It includes information from 86 angel investing groups in North America covering 539 individual investors who made 3097 investments, resulting in 1137 exits (Wiltbank and Boeker 2007). Our analysis follows that of Gregson et al (2017). It is based on a cleaned dataset of responses from 13% ($n = 70$) of those investors who reported data on exits. Given that investors may be reluctant to acknowledge or report on unsuccessful exits (Harrison et al 2016; McDonald and DeGennaro 2016), selection bias may be present in the results (DeGennaro and Dwyer 2009; Wiltbank and Boeker 2007), although there is little evidence of response bias (DeGennaro and Dwyer 2014). Specifically, we simulate portfolios ranging from 5-250 investments, an investing window of 0-10 years, portfolio hold times ranging from 10 to 25 years and incorporate the impact of taxes, including tax-loss benefits associated with writing off investments. In total, we have simulated more than 11 million portfolios, totalling over 240 million hypothetical investments.

First, we addressed the issue of angel investment tax incentives. We ran the simulation analysis to incorporate a 25% tax incentive on angel investments. In this analysis, investors receive a cash tax incentive of 25% of the total investment amount, regardless of the year of investment. We incorporated United States capital gains taxes into the analysis: this currently imposes a 25% tax rate on gains obtained in less than one year and a 15% tax rate on gains obtained beyond one year. Tax losses must be distributed over time at a maximum of \$3,000 per year. Because of the technical complexity of incorporating this into the analysis, we have instead simply assumed that tax losses would be recognized in the year obtained. While this is arbitrary

and counter to actual tax accounting, it is a necessary simplification to recognize the value of tax loss harvesting.

Second, we report the results of the basic taxation analysis. The tax credit was implemented as a one-time positive cash flow equal to 25% of the investment amount in whatever year the investment was made. As would be expected, this results in a significant positive impact on returns, as most of the credits are obtained in the first year. Capital gains/loss tax was implemented as one-time negative/positive cash flows based on a 25% short-term and 15% long-term rate.

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Table 1 **Stylised facts about angel investing**

| Stylised fact | Conventional wisdom | Challenges and corrections |
|--------------------------|--|--|
| Available capital | <p>As or more important as VC in early stage funding (Sohl 2003; Mason and Harrison 2000; Goldfarb et al 2007; OECD 2011)</p> <p>Widely distributed nationally and internationally (Harrison 2017; Cumming and Zhang 2019)- ‘angels live everywhere’ (Gaston 1990, 273)</p> <p>More broadly based than the spatialities of VC (Angel Research Institute 2018)</p> | <p>Availability is function of legal, regulatory, economic and cultural differences (Cumming and Zhang 2019)</p> <p>Availability follows geography of entrepreneurial economy – 60-80% angels are cashed-out/current entrepreneurs</p> <p>Thick market (where financiers are more willing to enter a market that is crowded by entrepreneurs and vice versa) (Cipollone and Giorani 2019) and other network effects lead to clusterization of economic activity</p> |
| Local capital | <p>Angel investments, by preference and outcome, are close to home (Wetzel 1983; Harrison et al 2010)</p> <p>Proximity capital:</p> <ul style="list-style-type: none"> - Social networks provide deal flow - Due diligence is personalised (Harrison and Mason 2018) - Post-investment involvement (Politis 2008; 2016) - Network effects: information and knowledge spillovers (Stuart and Sorenson 2003) - Regional development drive as VC increasingly centralised and internationalized (Harrison and Mason 2019; Harrison et al 2020) | <p>Significant minority (20-35%) invest long-distance and small minority (5-8%) invest internationally (Harrison et al 2010; EBAN 2007; European Commission 2016)</p> <p>Signalling, certification and credentialization effects (Kim and Wagman 2016):</p> <ul style="list-style-type: none"> - Contradictory evidence on extent to which angels do (Kerr et al 2014; Schwienbacher 2007; Elitzur and Gavius 2003) or do not (Cumming and Zhang 2019) provide investees with certification effects in VC-entrepreneur interactions - Implication - in any region the most successful entrepreneurs will choose VC before angel finance even if it is outside the region |
| Bridging capital | <p>Funding escalator (North 2013; Gregson 2014; Murzacheva and Levie 2020) or relay race (Benjamin and Margulis 2000) – angels ‘pass the funding baton’ to VCs in integrated entrepreneurial finance ecosystem</p> | <p>Collapse of funding escalator (Mason et al 2019) – angels are now ‘cradle to grave’ investors from start-up to exit (Harrison et al 2010; Mason et al 2015)</p> <ul style="list-style-type: none"> - Lengthens angel investor’s holding period (Harrison et al 2010) |

| | | |
|----------------------------------|---|--|
| | | <ul style="list-style-type: none"> - Angels make more follow-on investments in existing portfolio companies than in new (to them) companies (Mason et al 2015; 2019) - Discouraged demand and downward realignment of entrepreneurs' expectations (Harrison et al 2010) <p>Segmentation of early-stage risk capital market – angels at early stages. VC at later stages (Chemmanur and Chen 2006; 2014)</p> <ul style="list-style-type: none"> - Investor risk preferences (Pandher 2019; Schwienbacher 2009) - Friend or foe theory (Hellmann and Thiele 2015) – entrepreneurs prefer VC to angel finance - Angel and VC are dynamic substitutes not complementary – angel-backed companies less likely to obtain VC (Hellmann et al 2015) - 'parallel tracks' (Hellmann et al 2017; Dutta and Folta 2016) not 'stepping stones' (Cumming and Zhang 2019) |
| <p>Productive capital</p> | <p>Widespread belief, in academic as well as policy and practice circles, that angel investment is economically justified (Ali et al 2017; Dutta and Folta 2016)</p> <p>Belief that compared to VCs angels expect lower returns over longer time horizon (Shane 2012)</p> <p>Limited evidence on investment practices and performance (Bonini et al 2018; 2019; Capizzi 2015; Botelho et al 2019; Antretter et al 2018)</p> | <p>Is it worth it? (Mason and Harrison 2002):</p> <ul style="list-style-type: none"> - 50-65% of angel investments written off/fail to return original investment (Gregson et al 2017; Wiltbank and Boeker 2007) - High-performing investments are black swan events (Taleb 2007) – rare and a priori unpredictable - Risk (the prospect of loss – Tennert et al 2019) is incommensurate with likely returns - Limited evidence of angel learning from experience (Harrison et al 2015) |
| <p>Inefficient market</p> | <p>Policy based on an 'inefficient market' hypothesis</p> <p>Information and signalling deficiencies (Collewaert et al 2010)</p> | <p>No simple definition of market failure (Martin and Scott 2000)</p> <p>Market as a matching process (Phelps 2009)</p> |

| | | |
|--|---|--|
| | <p>Information symmetries, adverse selection and moral hazard (Landstrom 1995)</p> <p>Differences in risk-returns expectations held by different market actors (Ivashina and Lerner 2019; Harrison et al 2016)</p> | <p>Governments create market failure by leveraging inappropriate finance provision to support artificial demand (Lerner 2009)</p> |
| <p>Government support necessary</p> | <p>Intervention necessary to address market failure (Mason 2009)</p> <ul style="list-style-type: none"> - Tax incentives - Support for angel group/network operating costs - Coinvestment schemes (Harrison 2018; Owen and Mason 2017) | <p>Limited assessment of effectiveness of policy interventions</p> <p>The challenge of assortive matching (Hsu 2004; Sørensen 2007; Ewens et al 2019)</p> <p>Implications of poor risk-adjusted returns (Shane 2009; Gregson et al 2013; 2017; Mason and Brown 2013; Pierrakis 2011)</p> |

Table 2: The cost of tax relief to support the funding of startup and early stage companies in the UK (£m)

| | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | Total | No. of beneficiaries |
|--------------------------|------------|------------|------------|------------|-------------|-------------|-------------|----------------------|
| Income tax | | | | | | | | |
| EIS | 450 | 540 | 545 | 590 | 650 | 600 | 3375 | 35000 |
| SEIS | 85 | 85 | 85 | 95 | 105 | 105 | 560 | 9600 |
| VCT | 130 | 130 | 135 | 170 | 225 | 175 | 965 | 1300 |
| | | | | | | | | |
| Capital gains tax | | | | | | | | |
| EIS | 115 | 135 | 120 | 125 | 145 | 120 | 720 | |
| | | | | | | | | |
| Total | 790 | 890 | 885 | 980 | 1125 | 1000 | 5620 | |

Notes EIS – Enterprise Investment Scheme: angels can gain both income tax and capital gains tax relief when they subscribe for eligible shares in small unquoted companies that qualify

SEIS – Seed Enterprise Investment Scheme: angel investors can receive enhanced tax relief (up to 50% relief) on making investments in very small businesses with growth potential that are at a very early seed or start-up stage, which have only just started trading and may have little or no revenues and very few assets

VCT - Venture Capital Trusts are investment companies listed on the London Stock Exchange, which raise money from wealthy or sophisticated investors, who receive tax relief on their investments) and use it to invest in young, innovative, and often (but not necessarily) privately-owned companies

Source HMRC (2019) Estimated costs of principal tax reliefs. Available at

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=27&ved=2ahUKEwib-sfCj9rlAhVNe8AKHUg1C-4FBAWMAZ6BAgJEA1&url=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F823740%2FJan19_Principal_Reliefs_Final_Revised_for_Marriage_allowance.ods&usg=AOvVaw33-kzn0k9wIGI-GsU0zIC0

Figure 1: Taxation Effects and Median IRR: Portfolios up to 50 Investments

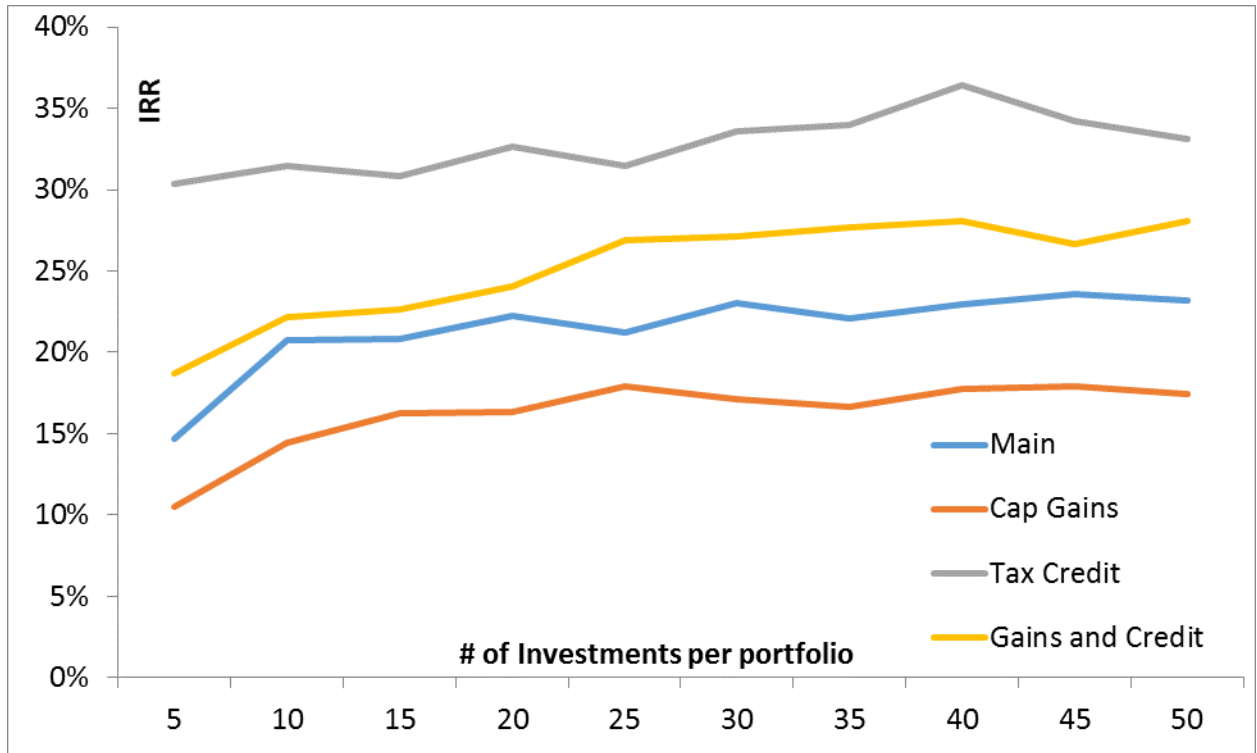


Figure 2: Taxation Effects and Median IRR: All Portfolio Sizes

